# Prevalence and determinants of job stress in patients with inflammatory bowel disease

Schreiner, Philipp ; Biedermann, Luc ; Rossel, Jean-Benoit ; Rogler, Gerhard ; Pittet, Valérie ; von Känel, Roland ; Swiss IBD Cohort Study Group

Abstract: BACKGROUND Psychosocial factors have been shown to predict a poor disease course in patients with inflammatory bowel disease (IBD), but whether this applies to job stress is currently unknown. We assessed the prevalence of job stress and its correlates in a large cohort of patients with IBD. METHODS We included all adult, professionally active patients enrolled between 2006 and 2015 in the Swiss IBD Cohort. Job stress was measured through the self-report effort-reward imbalance ratio and overcommitment (OC) to work questionnaires. We used multiple linear regressions to assess association with sociodemographic, lifestyle, psychosocial, and disease-related factors. RESULTS Altogether 1656 patients completed the questionnaires (905 Crohn's disease and 751 ulcerative colitis/IBD unclassified). Only 91 (5.7%) of patients had an effort-reward imbalance ratio >1. Effort-reward imbalance and OC scores were higher in full-time versus part-time employees (coef = 0.050, P = 0.002; coef = 0.906, P < 0.001) and among those absent from the workplace in the previous 3 months (coef = 0.049, P = 0.010; coef = 1.062, P < 0.001). Higher OC scores were associated with sex (women vs. men: coef = 0.568, P = 0.014), being in a relationship (coef = 0.805, P = 0.001), higher level of occupation (director vs. trainee: coef = 1.447, P < 0.001), and extraintestinal manifestations (coef = 0.623, P = 0.005). Patients hospitalized in the previous 12 months had lower OC scores (coef = 0.560, P = 0.038). CONCLUSIONS The average level of job stress seems to be remarkably low in patients with IBD from Switzerland. The clinician should turn attention especially to women, full-time employees with a high level of education, and patients with extraintestinal manifestations to identify those with the most vulnerability to suffer from job stress.

DOI: https://doi.org/10.1097/MIB.0000000000001012

# Prevalence and Determinants of Job Stress in Patients with Inflammatory Bowel Disease

*Philipp Schreiner, MD,* Luc Biedermann, MD,* Jean-Benoit Rossel, PhD,† Gerhard Rogler, MD, PhD,* Valérie Pittet, PhD,† and Roland von Känel, MD, PhD,‡,§ Swiss IBD Cohort Study Group*

**Background:** Psychosocial factors have been shown to predict a poor disease course in patients with inflammatory bowel disease (IBD), but whether this applies to job stress is currently unknown. We assessed the prevalence of job stress and its correlates in a large cohort of patients with IBD.

**Methods:** We included all adult, professionally active patients enrolled between 2006 and 2015 in the Swiss IBD Cohort. Job stress was measured through the self-report effort–reward imbalance ratio and overcommitment (OC) to work questionnaires. We used multiple linear regressions to assess association with sociodemographic, lifestyle, psychosocial, and disease-related factors.

**Results:** Altogether 1656 patients completed the questionnaires (905 Crohn's disease and 751 ulcerative colitis/IBD unclassified). Only 91 (5.7%) of patients had an effort–reward imbalance ratio >1. Effort–reward imbalance and OC scores were higher in full-time versus part-time employees (coef = 0.050, $P = 0.002$; coef = 0.906, $P < 0.001$) and among those absent from the workplace in the previous 3 months (coef = 0.049, $P = 0.010$; coef = 1.062, $P < 0.001$). Higher OC scores were associated with sex (women vs. men: coef = 0.568, $P = 0.014$), being in a relationship (coef = 0.805, $P = 0.001$), higher level of occupation (director vs. trainee: coef = 1.447, $P < 0.001$), and extraintestinal manifestations (coef = 0.623, $P = 0.005$). Patients hospitalized in the previous 12 months had lower OC scores (coef = 0.560, $P = 0.038$).

**Conclusions:** The average level of job stress seems to be remarkably low in patients with IBD from Switzerland. The clinician should turn attention especially to women, full-time employees with a high level of education, and patients with extraintestinal manifestations to identify those with the most vulnerability to suffer from job stress.

*(Inflamm Bowel Dis 2017;23:310–317)*

**Key Words:** Crohn's disease, ulcerative colitis, effort–reward imbalance

Inflammatory bowel disease (IBD), Crohn's disease (CD) and ulcerative colitis (UC), are chronic and incurable diseases with a relapsing and remitting course. There is still no cure or proven causal treatment option within reach, and the incidence and prevalence in Europe has still been increasing in the last years.[1] Aside from the interactions of genetic, immunologic, and microbial factors,[2] there are various environmental triggers that promote the development of CD and UC and subsequent flares.[1] Importantly, the relevance of the former group of factors—above all genetics—has most likely been underestimated in recent years, as only changes in environmental factors may concisely explain the dramatic increase in prevalence and incidence of IBD in developing countries.[3] One of these environmental triggers could be psychological stress.[4]

The mechanisms linking psychological stress with intestinal inflammation are not fully understood. Nonetheless, there is evidence to suggest that psychological stress induces intestinal inflammation by impairing mucosal defenses against luminal bacteria,[5] stimulates eosinophils to produce corticotropin-releasing hormone in the intestine,[6] and alters the phenotypes of regulatory T cells in the intestine such as, mediated by prolactin, a stress-derived mediator.[7]

An increasing number of well-designed large-scale investigations provide evidence that psychological factors are linked to the course of IBD, especially chronic stress in UC and depressive symptoms in CD.[8,9] Despite the uncertainty from the available studies, interestingly, over 50% of patients with IBD "believe" that psychological factors play a major role in the course of their disease.[9,10] Nevertheless, patients evidently define the disease course based on perceived symptoms and not on the degree of intestinal inflammation. However, clinical symptoms and intestinal inflammation do not necessarily correspond with each other and thus should not be considered equivalent. For instance, a recent study showed a relationship between perceived stress

Received for publication November 18, 2016; Accepted November 29, 2016.

From the *Division of Gastroenterology and Hepatology, University Hospital of Zurich, Zurich, Switzerland; †Institute of Social and Preventive Medicine, Lausanne University Hospital, Lausanne, Switzerland; ‡Department of Psychosomatic Medicine, Clinic Barmelweid, Barmelweid, Switzerland; and §Department of Neurology, Bern University Hospital, and University of Bern, Inselspital, Bern, Switzerland.

Supported by research grants from the Swiss National Science Foundation to the Swiss IBD Cohort (Grant No. 3347CO-108792).

Poster presentation at 11th Congress of ECCO—Inflammatory Bowel Diseases; March 18, 2016, Amsterdam, The Netherlands.

The authors have no conflict of interest to disclose.

Address correspondence to: Philipp Schreiner, MD, Division of Internal Medicine, University Hospital of Zurich, Rämistrasse 100, Zurich 8091, Switzerland (e-mail: philipp.schreiner@usz.ch).



DOI 10.1097/MIB.0000000000001012

Published online 11 January 2017.

and gastrointestinal symptoms, but stress perception was unrelated to the concurrent intestinal inflammation.[11] Though, significantly more people with an inactive disease indicate an absence of stressful events.[12] In addition, there is considerable interpatient variation regarding the severity of symptoms with nearly the same amount of disease activity.[13] Moreover and further complicating this complex interrelation, there is also a considerable prevalence of functional gastrointestinal symptoms in patients with IBD.[14]

Psychosocial factors have been shown to negatively impact the course of IBD, particularly elevated levels of anxiety and depressive symptoms.[15–17] However, anxiety and depression may reflect one psychological dimension (i.e., negative affect) among many. For instance, although a recently published study found that job stress was not a major risk factor for incident CD or UC,[18] work-related stress still might influence the disease course. After all, regardless of disease activity, the most commonly reported stressors in patients with IBD were family stress, followed by work and school stress.[12] Work-related stress can not only increase morbidity and mortality in different ways[19–21] but also is of huge economic relevance. Specifically, the financial costs of work-related stress account for 1.2% of the gross domestic product of Switzerland[22] as well as an annual amount of 20 billion euros for all EU Member states[23] and 300 billion US dollars for the US economy.[24,25]

To the best of our knowledge, as yet, there have been no large-scale investigations on job stress in patients with IBD. Therefore, we undertook a cross-sectional study to estimate the prevalence of job stress and to identify its correlates, including demographic, psychosocial, and disease-related factors, in patients with IBD.

We chose the effort–reward imbalance (ERI) questionnaire to assess job stress because it is a validated model and used in many different studies to investigate job stress and its associations.[26–28] A high overcommitment (OC) score and a high ERI score are associated with depression[29–31] and anxiety,[32] which both can influence negatively the course of IBD as delineated above.

## MATERIALS AND METHODS

### Design and Clinical Setting

We used prospective and retrospective data from the baseline questionnaires from adult patients included in the Swiss IBD Cohort between 2006 and 2015.[33]

Data were collected in multiple hospitals and private practices throughout Switzerland during the enrollment with both, physician-based and self-administered questionnaires.

### Measures

Clinical and disease-related factors were obtained by physician questionnaire. Sociodemographic information, lifestyle factors, and psychosocial measures were collected through self-report questionnaires. Job stress was measured using the self-report ERI and OC to work questionnaires. We used the original long version of the ERI and OC questionnaires with 23 items overall.[34] Effort spent at work is measured by 6 questions with 5 response options[1]: disagree,[2] agree and I am not at all distressed,[3] agree and I am somewhat distressed,[4] agree and I am distressed,[5] agree and I am very distressed. A total effort sum score varies between 6 and 30. The higher the score, the more effort at work is felt by the subject. Reward obtained at work is measured with 11 questions with the same response categories as used for the effort scale. The total reward sum score varies between 11 and 55. The higher the score, the more reward obtained at work is felt by the person. The ERI ratio shows the imbalance between effort spent and reward obtained at the individual level (note that a correction factor is applied to adjust for the unequal number of items of the effort and reward scores). Specifically, for an ERI ratio $< 1$, less effort spent than reward obtained is supposed to be perceived by the person, whereas for an ERI ratio $> 1$, there is more effort spent than reward obtained at work. It should be noted that an ERI threshold of equal to 1 does not reflect the presence or absence of perceived job stress, so it cannot be used as a clinically validated threshold.[34] In other words, the use of continuously scaled ERI scores yields more power. Typical items are "I have constant time pressure due to a heavy work load" (effort) and "I receive the respect I deserve from my superior or a respective relevant person" (reward). The OC to work scale consists of 6 items to be rated on a Likert-scale from 1 (low) to 4 (high OC) with a minimum of 6 points and a maximum of 24 points for the total OC sum score. Typical OC items are "People close to me say I sacrifice too much for my job" and "I get easily overwhelmed by time pressures at work." The following independent variables were used to study potential associations with job stress:

#### *Clinical Characteristics*

The clinical characteristics include IBD subtype, disease activity (Crohn's Disease Activity Index, CDAI, for CD, Modified Truelove and Witts severity index for UC), C-reactive protein (continuous), complications (colorectal cancer, colonic dysplasia, intestinal lymphoma, osteopenia, anemia, deep venous thrombosis, pulmonary embolism, gallstones, nephrolithiasis, malabsorption syndrome, massive hemorrhage, perforation/peritonitis, and growth failure [binary]), fistula, abscess or anal fissure, stenosis, hospitalizations related to IBD in the previous 12 months, surgery, extraintestinal manifestations (peripheral arthritis, uveitis/iritis, pyoderma gangrenosum, erythema nodosum, aphthous oral ulcers, stomatitis, ankylosing spondylitis, and primary sclerosing cholangitis [binary]), drinking alcohol (categorical), smoking status (binary), and medications (steroids, immunomodulators, and tumor necrosis factor antagonists [binary]).

#### *Demographics at Baseline*

The demographics at baseline include age, sex, level of education (categorical), current work (categorical), level of sport activity (categorical), absence from work in the previous 3 months

**TABLE 1.** Personal, Work-related and Disease-related Characteristics

| | CD | UC/IC | Total |
|---|---|---|---|
| Personal characteristics: | | | |
| Total number of patients, % | 905 (54.6) | 751 (45.4) | 1656 |
| Males, % | 441 (48.7) | 411 (54.7) | 852 (51.4) |
| Age at diagnosis (mean, q25–q75, min–max, n) | 28.5 (20–35, 3–68, n = 905) | 32.0 (24–38, 8–69, n = 749) | 30.1 (22–37, 3–69, n = 1654) |
| Age at enrollment (mean, q25–q75, min–max, n) | 39.1 (29–49, 17–75, n = 905) | 40.8 (32–49, 17–69, n = 751) | 39.9 (30–49, 17–75, n = 1656) |
| Having a partner, % | | | |
| No | 281 (31.0) | 177 (23.6) | 458 (27.7) |
| Yes | 614 (67.9) | 567 (75.5) | 1181 (71.3) |
| Missing | 10 (1.1) | 7 (0.9) | 17 (1.0) |
| Having children, % | | | |
| No | 500 (55.2) | 344 (45.8) | 844 (51.0) |
| Yes | 389 (43.0) | 399 (53.1) | 788 (47.6) |
| Missing | 16 (1.8) | 8 (1.1) | 24 (1.4) |
| Sport, % | | | |
| Never | 258 (28.5) | 182 (24.2) | 440 (26.6) |
| Weekly | 375 (41.4) | 297 (39.5) | 672 (40.6) |
| Daily | 253 (28.0) | 258 (34.4) | 511 (30.9) |
| Missing | 19 (2.1) | 14 (1.9) | 33 (2.0) |
| Alcohol consumption, % | | | |
| Never | 516 (57.0) | 379 (50.5) | 895 (54.1) |
| Weekly | 336 (37.1) | 327 (43.6) | 663 (40.0) |
| Daily | 49 (5.4) | 32 (4.3) | 81 (4.9) |
| Missing | 4 (0.4) | 13 (1.7) | 17 (1.0) |
| Smoking status (at enrollment), % | | | |
| No | 560 (61.9) | 612 (81.5) | 1172 (70.8) |
| Yes | 344 (38.0) | 134 (17.8) | 478 (28.9) |
| Missing | *1 (0.1)* | 5 (0.7) | 6 (0.4) |
| Work-related characteristics: | | | |
| Total number of patients, % | 905 (54.6) | 751 (45.3) | 1656 |
| Education, % | | | |
| Elementary (1–4)[a] | 404 (44.6) | 305 (40.6) | 709 (42.8) |
| Middle (5–9)[a] | 160 (17.7) | 132 (17.6) | 292 (17.6) |
| High (10–13)[a] | 329 (36.4) | 309 (41.1) | 638 (38.5) |
| Missing | 12 (1.3) | 5 (0.7) | 17 (1.0) |
| Current work, % | | | |
| Trainee or employee | 523 (57.8) | 403 (53.7) | 926 (55.9) |
| Intermediate manager | 222 (24.5) | 194 (25.8) | 416 (25.1) |
| Director | 56 (6.2) | 64 (8.5) | 120 (7.3) |
| Missing | 104 (11.5) | 90 (12.0) | 194 (11.7) |
| Activity rate, % | | | |
| Part time | 274 (30.3) | 255 (34.0) | 529 (31.9) |
| Multiple part time | 40 (4.4) | 38 (5.1) | 78 (4.7) |
| Full time | 591 (65.3) | 458 (61.0) | 1049 (63.4) |
| Missing at work in the last 3 mo, % | | | |
| No | 708 (78.2) | 608 (81.0) | 1316 (79.5) |
| Yes | 177 (19.6) | 139 (18.5) | 316 (19.1) |

**TABLE 1.** (*Continued*)

| | CD | UC/IC | Total |
|---|---|---|---|
| Missing | 20 (2.2) | 4 (0.5) | 24 (1.4) |
| OC (mean, q25–q75, min–max, n) | 13.5 (10–16, 6–24, n = 892) | 13.5 (11–16, 6–24, n = 743) | 13.5 (10.8–16, 6–24, n = 1635) |
| Effort (mean, q25–q75, min–max, n) | 12.8 (9–16, 6–30, n = 886) | 12.8 (9–16, 6–29, n = 740) | 12.8 (9–16, 6–30, n = 1626) |
| Reward (mean, q25–q75, min–max, n) | 48.8 (46–54, 11–55, n = 866) | 49.7 (47–55, 11–55, n = 732) | 49.2 (47–55, 11–55, n = 1598) |
| Effort–reward ratio (mean, q25–q75, min–max, n) | 0.5 (0.3–0.6, 0.2–5, n = 863) | 0.5 (0.3–0.6, 0.2–3.5, n = 732) | 0.5 (0.3–0.6, 0.2–5, n = 1595) |
| Effort–reward ratio greater than 1, % | | | |
| No | 812 (89.7) | 692 (92.1) | 1504 (90.8) |
| Yes | 51 (5.6) | 40 (5.3) | 91 (5.5) |
| Missing | 42 (4.6) | 19 (2.5) | 61 (3.7) |
| Disease-related characteristics: | | | |
| Total number of patients, % | 905 (54.6) | 751 (45.3) | 1656 |
| CDAI (mean, q25–q75, min–max, n) | 49.7 (11–76, 0–435, n = 905) | | |
| MTWAI (mean, q25–q75, min–max, n) | | 3.5 (1–5, 0–19, n = 751) | |
| Extraintestinal manifestations, % | | | |
| No | 548 (60.6) | 538 (71.6) | 1086 (65.6) |
| Yes | 357 (39.4) | 213 (28.4) | 570 (34.4) |
| Complications, % | | | |
| No | 526 (58.1) | 500 (66.6) | 1026 (62.0) |
| Yes | 379 (41.9) | 251 (33.4) | 630 (38.0) |
| Fistula/abscess/anal fissure, % | | | |
| No | 552 (61.0) | | |
| Yes | 353 (39.0) | | |
| Stenosis, % | | | |
| No | 604 (66.7) | | |
| Yes | 301 (33.3) | | |
| Previous hospitalization related to IBD, % | | | |
| No | 714 (78.9) | 616 (82.0) | 1330 (80.3) |
| Yes | 191 (21.1) | 135 (18.0) | 326 (19.7) |
| Surgery, % | | | |
| No | 515 (56.9) | 724 (96.4) | 1239 (74.8) |
| Yes | 390 (43.1) | 27 (3.6) | 417 (25.2) |
| Therapy (at least once), % | | | |
| Steroids | 726 (80.2) | 553 (73.6) | 1279 (77.2) |
| Immunomodulators | 683 (75.5) | 388 (51.7) | 1071 (64.7) |
| Anti-TNF | 396 (43.8) | 146 (19.4) | 542 (32.7) |

[a]These numbers about education refers to the list of possible answers in the patient's questionnaire. The first 4 answers give a "low" education; the last 4 answers give a "high" education, whereas the 5 answers in-between give a "middle" education.
CDAI, Crohn's Disease Activity Index; MTWAI, Modified Truelove & Witts Activity Index; TNF, tumor necrosis factor.

(binary), marital status/living in a partnership (binary), having children (binary), and doing sports (categorical).

## Participants

Among the total of 3385 patients enrolled in the Swiss IBD Cohort, 2435 (72%) filled in the self-reported questionnaire. Seven hundred seventy-nine patients were excluded from the analysis presented here because of unemployment. Of the remaining 1656 patients, the OC and ERI scores were available in 1635 patients and 1595 patients, respectively. The OC score was computed by summing up the 6 corresponding items. If at most 2 items were missing, we considered the average of completed items multiplied by 6. No imputation was done if 3 or more items were missing. We applied the same procedure to effort (also computed with 6 items) and reward scores; the latter was only calculated if a maximum of 3 items (among 11) were missing.

The ethical committees of all cantons where participants were included approved the Swiss IBD Cohort Study. Participants were enrolled only after they had provided written informed consent.

## Data Analysis

Descriptive analyses and linear regressions were conducted using STATA statistical software v.14.1 (STATA Corp., College Station, TX). We performed a multivariate linear regression model with continuously scaled ERI ratio and OC scores as response variables. The beta coefficients were unstandardized. To compare the average OC score between multiple groups, a bilateral Student's *t* test was used. A *P*-value of $< 0.05$ was regarded as statistically significant.

# RESULTS

## Descriptive Statistics

Table 1 shows the characteristics of patients per disease category (CD and UC/IC). From a total of 1656 patients, the ERI ratio was measured from 1595 patients of whom 863 (54.1%) had CD and 732 (45.9%) had UC/IC. There were missing data of 61 patients regarding the ERI ratio.

Regarding the prevalence of high job stress levels, of all 1595 patients, only 91 (5.71%) had an ERI ratio $> 1$ (Fig. 1). The median ERI score in our patient with IBD was 0.5. There was no significant difference in the proportion of an ERI ratio $>1$ between men (6.43%) and women (4.92%) and between CD (5.90%) and UC/IC (5.46%) patients. Moreover, 430 patients (26.91%) reached the maximum reward score of 55.

## Predictors of Job Stress

### *ERI Ratio*

The continuously scaled ERI scores were significantly higher in patients with greater OC scores (coef = 0.034, 95% confidence interval: 0.030–0.038, $P < 0.001$), in full-time employed participants (coef = 0.050, 95% confidence interval: 0.018–0.082, $P = 0.002$), and in those with absence from the workplace in the previous 3 months (coef = 0.049, 95% confidence interval: −0.087 to 0.012, $P = 0.010$) (Table 2). The higher ERI score in full-time workers is explained by higher effort (Table 3) and not by lower reward (data not shown). There emerged no significant relationships between ERI scores and the remainder of predictor variables, namely age, sex, level of education, level of sport activity, living in a partnership, having children, doing sports, alcohol consumption, smoking status, disease activity, CRP, medications, extraintestinal manifestations, complications, fistula (or abscess or anal fissure), stenosis, hospitalizations related to IBD in the previous 12 months, and surgery.

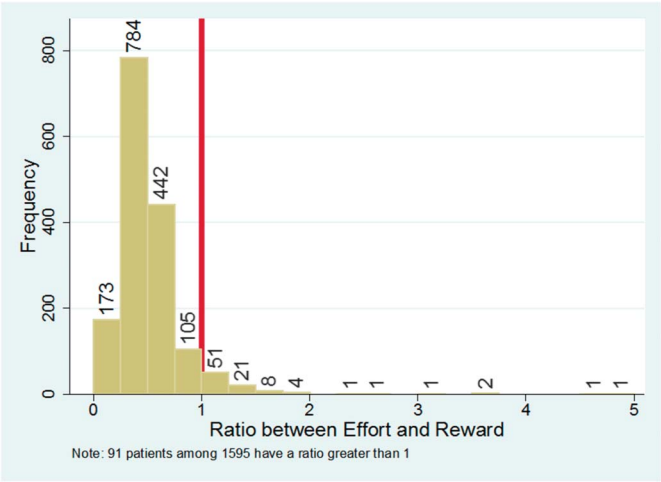


FIGURE 1. Note: 91 patients among 1595 have a ratio greater than 1.

### *OC to Work*

As opposed to ERI scores, OC scores were associated with a number of demographic, job-related and disease-related variables (Table 4 for the corresponding multivariate model and see Fig. 2 for *t*-tests on each factor). In the fully adjusted model, higher OC scores were found in women than men (coef = 0.568, $P = 0.014$) and in patients living with a partner compared with those not cohabiting (coef = 0.805, $P = 0.001$). In addition, OC scores were greater with a higher level of occupation (director versus trainee: coef = 1.447, $P < 0.001$) in full-time employees (coef = 0.906, $P < 0.001$) and in those with absence from work in the previous 3 months (coef = 1.062, $P < 0.001$). Although extraintestinal manifestations of IBD were associated with higher OC scores (coef = 0.623, $P = 0.005$), patients with a hospitalization in the previous 12 months had lower OC scores (coef = 0.560, $P = 0.038$).

# DISCUSSION

This large cross-sectional study assessed the prevalence of job stress along with its determinants in a Swiss IBD population, using the widely applied ERI and OC self-report questionnaire. Job stress measured with this instrument has previously been shown to be associated with and predict physical health across different diseases.[35–37] The novel aspect of our study is that, to our knowledge, it is the first to systematically evaluate job stress in a large cohort of patients with IBD.

We found the prevalence of job stress to be intriguingly low in our patients with IBD. Specifically, in our study, the proportion of participants with an ERI ratio greater than 1 was below 6%, whereas, in a population of teachers and nurses from Germany, it was 21.6% and 20.7%, respectively.[38,39] Also, the median ERI score in our patient with IBD was 0.5 and thus lower when compared with a general working population in Germany with a median of 0.57[40] or 0.65.[41] Moreover, one out of 4 patients in our study attained the highest possible reward score. Several possible, although speculative, mechanisms might explain this finding. For instance, it could be that our patients answered to job stress items in a more socially desirable way than working

**TABLE 2.** Linear Regression Model with Effort–Reward Ratio as Response

| Multivariate Linear Regression (Response: ERI, n = 1573) | Coefficient (95% CI; *P*) |
|---|---|
| Missing at work in the last 3 mo | |
| No | 0 (Ref) |
| Yes | 0.049 (0.012 to 0.087; 0.010) |
| Activity rate | |
| Partial time | 0 (Ref) |
| Multiple partial time | 0.021 (−0.052 to 0.094; 0.571) |
| Full time | 0.050 (0.018 to 0.082; 0.002) |
| OC | 0.034 (0.030 to 0.038; <0.001) |

CI, confidence interval.

populations particularly surveyed for work-related issues. Denial of job stress, as a way of coping with social disadvantages posed by a chronic disease, could also apply as an explanation. Eventually, Switzerland's relatively high levels of job security and social welfare might sever perceived job stress. Importantly, low levels of job stress do not necessarily discount a possible impact on the disease course, particularly if denial of job stress were of an issue; however, this clearly needs to be investigated prospectively.

We further found that ERI and, even more so OC to work, were associated with various socioeconomic variables, as well as with work- and disease-related factors. Women and those living with a partner showed greater OC than men and those not cohabiting, respectively. Perhaps not surprisingly, patients with IBD with full-time employment had greater levels of ERI and OC scores, as part-time employment should, on average, facilitate opportunities to unwind from job obligations, for instance through cognitive and mental distraction, while focusing on family and leisure-time activities. Nevertheless, the opposite could also be an explanation, as it might be that patients with high levels of perceived job stress and OC might have felt incapable of continuing full-time work and, therefore, applied for part-time jobs, perhaps with additional financial support from an invalidity pension. Therefore, our findings support the notion that part-time work may be a reasonable strategy to prevent any adverse effects on psychological well-being that might ultimately end up in frank exhaustion ("burn-out") and ultimately depression in patients with IBD having increased job stress and OC.

**TABLE 3.**

| Multivariate Linear Regression (Response: Effort, n = 1433) | Coefficient (95% CI; *P*) |
|---|---|
| Current work | |
| Employee or trainee | 0 (Ref) |
| Intermediate manager | 0.897 (0.435 to 1.359; <0.001) |
| Director | 0.644 (−0.109 to 1.397; 0.094) |
| Activity rate | |
| Partial time | 0 (Ref) |
| Multiple partial time | −0.465 (−1.786 to 0.255; 0.141) |
| Full time | 1.026 (0.583 to 1.468; <0.001) |
| OC | 0.604 (0.553 to 0.655; <0.001) |

CI, confidence interval.

**TABLE 4.** Linear Regression Model with OC as Response

| Multivariate Linear Regression (Response: OC, n = 1421) | Coefficient (95% CI; *P*) |
|---|---|
| Sex | |
| Male | 0 (Ref) |
| Female | 0.568 (0.114 to 1.022; 0.014) |
| Current work | |
| Trainee or employee | 0 (Ref) |
| Intermediate manager | 1.343 (0.872 to 1.814; <0.001) |
| Director | 1.447 (0.677 to 2.218; <0.001) |
| Activity rate | |
| Partial time | 0 (Ref) |
| Multiple partial time | −0.033 (−1.076 to 1.011; 0.951) |
| Full time | 0.906 (0.419 to 1.392; <0.001) |
| Missing at work in the last 3 mo | |
| No | 0 (Ref) |
| Yes | 1.062 (0.530 to 1.594; <0.001) |
| Having a partner | |
| No | 0 (Ref) |
| Yes | 0.805 (0.350 to 1.260; 0.001) |
| Extraintestinal manifestation | |
| No | 0 (Ref) |
| Yes | 0.623 (0.190 to 1.056; 0.005) |
| Previous hospitalization related to IBD | |
| No | 0 (Ref) |
| Yes | −0.560 (−1.088 to −0.032; 0.038) |

CI, confidence interval.

Rather expectedly, patients with IBD with more efforts spent than reward obtained at work reported more OC to work. This concurs with the notion that before exhaustion from chronic stress and "burnout" as well as depression sets in, workers are often trying to cope with increasing job demands through greater work engagement, thereby inevitably running the risk of depleting their energy resources further downstream.[27]

Such dynamics could also help to explain why patients with higher OC had more absence at the workplace. They may have ended up with depleted energy levels, ultimately leaving them unable to function in their job. However, we acknowledge that our

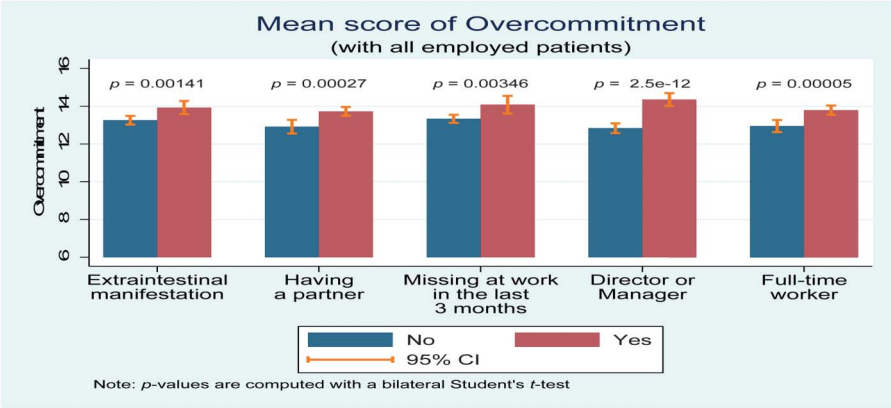


FIGURE 2. Mean score of OC (with all employed patients). Note: *P*-values are computed with a bilateral Student's *t* test.

cross-sectional design cannot exclude an opposite mechanism, whereby participants felt increasingly unable to unwind from job obligations because of high demands, and, indeed, OC showed a positive association with perceived efforts. For instance, as a consequence of health decline and functioning, there might arise a feeling that even for routine job tasks to be done, greater commitment than previously necessary is required. Also, a bidirectional association could explain the higher occupational grade in patients with greater OC scores. Although high OC to work may facilitate achievements careerwise, arriving in directorial positions usually requires a high level of commitment to comply with job profiles characterized by ambitious economic, managerial, and leadership skills.

As a screener, clinicians could ask patients with IBD as to whether they sometimes feel it difficult to detach from work. This feeling of being under job strain could additionally be substantiated by having patients filled in the ERI and OC questionnaires. If so, counseling for work–life balance issues and scheduling shorter intervals between follow-up visits for a closer disease monitoring may seem clinically reasonable means to perhaps benefit the disease course of patients overcommitted to work.

Our study has unavoidably some limitations. Different definitions of job stress exist, including the job demand/control model, which has also proven its usefulness for predicting incident episodes of somatic diseases and prognosis.[42,43] Other models refer to injustice at work and illegitimate tasks as key issues evoking job stress leading to adverse physical and mental health outcomes. For instance, work engagement may lead to depressive and anxiety symptoms,[44] both of which have been shown to be increased in patients with IBD and to also adversely impact the course of the disease.[15,17] Having said that, it is sometimes difficult to differentiate the various psychosocial factors that may play a role in IBD because the term "stress" unfortunately is used in many studies in different ways; therefore, some authors advocate to improve the standardization of future studies with the term "perceived stress".[45] Although there is accumulating evidence that stress acts as a trigger for gastrointestinal inflammation in IBD, especially long-term perceived stress in UC[46] and depressive symptoms in CD,[47] there is no systematically designed study that investigated specific stressors, like job stress, as a possible trigger for disease activity and relapses in CD and UC/IC. Future studies have to focus on a uniform definition for stress and to differentiate between the symptoms of the patients and the actual inflammation of the bowel.

## CONCLUSION

The level of job stress in the Swiss IBD population seems rather low. The groups with the highest levels for job stress were women, people in higher job positions, full-time workers, and patients with extraintestinal manifestations. The clinician should be aware of the patients with a higher risk for high OC or ERI scores and ask them about their work–life balance.

## ACKNOWLEDGMENTS

The authors wish to thank all the patients for their cooperation in answering the questionnaires.

## REFERENCES

1. Loftus EV Jr. Clinical epidemiology of inflammatory bowel disease: incidence, prevalence, and environmental influences. *Gastroenterology*. 2004;126:1504–1517.
2. Sartor RB. Mechanisms of disease: pathogenesis of Crohn's disease and ulcerative colitis. *Nat Clin Pract Gastroenterol Hepatol*. 2006;3:390–407.
3. Biedermann L, Rogler G. Environmental factors and their impact on the intestinal microbiota: a role for human disease? *Dig Dis*. 2012;30(suppl 3):20–27.
4. Bernstein CN, Singh S, Graff LA, et al. A prospective population-based study of triggers of symptomatic flares in IBD. *Am J Gastroenterol*. 2010;105:1994–2002.
5. Soderholm JD, Yang PC, Ceponis P, et al. Chronic stress induces mast cell-dependent bacterial adherence and initiates mucosal inflammation in rat intestine. *Gastroenterology*. 2002;123:1099–1108.
6. Zheng PY, Feng BS, Oluwole C, et al. Psychological stress induces eosinophils to produce corticotrophin releasing hormone in the intestine. *Gut*. 2009;58:1473–1479.
7. Wu W, Sun M, Zhang HP, et al. Prolactin mediates psychological stress-induced dysfunction of regulatory T cells to facilitate intestinal inflammation. *Gut*. 2014;63:1883–1892.

8. Rampton D. Does stress influence inflammatory bowel disease? The clinical data. *Dig Dis.* 2009;27(suppl 1):76–79.
9. Maunder RG, Levenstein S. The role of stress in the development and clinical course of inflammatory bowel disease: epidemiological evidence. *Curr Mol Med.* 2008;8:247–252.
10. Robertson DA, Ray J, Diamond I, et al. Personality profile and affective state of patients with inflammatory bowel disease. *Gut*. 1989;30: 623–626.
11. Targownik LE, Sexton KA, Bernstein MT, et al. The relationship among perceived stress, symptoms, and inflammation in persons with inflammatory bowel disease. *Am J Gastroenterol.* 2015;110:1001–1012; quiz 1013.
12. Singh S, Blanchard A, Walker JR, et al. Common symptoms and stressors among individuals with inflammatory bowel diseases. *Clin Gastroenterol Hepatol.* 2011;9:769–775.
13. Garrett JW, Drossman DA. Health status in inflammatory bowel disease. Biological and behavioral considerations. *Gastroenterology*. 1990;99: 90–96.
14. Simren M, Axelsson J, Gillberg R, et al. Quality of life in inflammatory bowel disease in remission: the impact of IBS-like symptoms and associated psychological factors. *Am J Gastroenterol.* 2002;97:389–396.
15. Camara RJ, Schoepfer AM, Pittet V, et al. Mood and nonmood components of perceived stress and exacerbation of Crohn's disease. *Inflamm Bowel Dis.* 2011;17:2358–2365.
16. Goodhand JR, Wahed M, Mawdsley JE, et al. Mood disorders in inflammatory bowel disease: relation to diagnosis, disease activity, perceived stress, and other factors. *Inflamm Bowel Dis.* 2012;18:2301–2309.
17. Mikocka-Walus A, Pittet V, Rossel JB, et al. Symptoms of depression and anxiety are independently associated with clinical recurrence of inflammatory bowel disease. *Clin Gastroenterol Hepatol.* 2016;14:829–835.e1.
18. Heikkila K, Madsen IE, Nyberg ST, et al. Job strain and the risk of inflammatory bowel diseases: individual-participant meta-analysis of 95,000 men and women. *PLoS One*. 2014;9:e88711.
19. Almadi T, Cathers I, Chow CM. Associations among work-related stress, cortisol, inflammation, and metabolic syndrome. *Psychophysiology*. 2013; 50:821–830.
20. Backe EM, Seidler A, Latza U, et al. The role of psychosocial stress at work for the development of cardiovascular diseases: a systematic review. *Int Arch Occup Environ Health.* 2012;85:67–79.
21. Tennant C. Work-related stress and depressive disorders. *J Psychosom Res.* 2001;51:697–704.
22. Ramaciotti D, Perriard J. *Die Kosten des Stresses in der Schweiz*. Bern, Switzerland: Staatssekretariat für Wirtschaft SECO; 2003.
23. Levi L, Levi I. *Guidance on Work-Related Stress—Spice of Life or Kiss of Death?* Luxembourg: Communities OfOPotE; 2000.
24. Matteson MT, Ivancevich JM. *Controlling Work Stress: Effective Human Resource and Management Strategies*. 1st ed. San Francisco, CA: Jossey-Bass; 1987.
25. Rosch PJ. The quandary of job stress compensation. *Health and Stress*. 2001;3:1–4.
26. van Vegchel N, de Jonge J, Bosma H, et al. Reviewing the effort-reward imbalance model: drawing up the balance of 45 empirical studies. *Soc Sci Med.* 2005;60:1117–1131.
27. Nuebling M, Seidler A, Garthus-Niegel S, et al. The Gutenberg Health Study: measuring psychosocial factors at work and predicting health and work-related outcomes with the ERI and the COPSOQ questionnaire. *BMC Public Health*. 2013;13:538.
28. Siegrist J, Starke D, Chandola T, et al. The measurement of effort-reward imbalance at work: European comparisons. *Soc Sci Med.* 2004;58:1483–1499.
29. Li J, Weigl M, Glaser J, et al. Changes in psychosocial work environment and depressive symptoms: a prospective study in junior physicians. *Am J Ind Med.* 2013;56:1414–1422.
30. Yu SF, Nakata A, Gu GZ, et al. Co-effect of Demand-control-support model and effort-reward imbalance model on depression risk estimation in humans: findings from Henan Province of China. *Biomed Environ Sci.* 2013;26:962–971.
31. Tsutsumi A, Kawanami S, Horie S. Effort-reward imbalance and depression among private practice physicians. *Int Arch Occup Environ Health.* 2012;85:153–161.
32. Proeschold-Bell RJ, Miles A, Toth M, et al. Using effort-reward imbalance theory to understand high rates of depression and anxiety among clergy. *J Prim Prev.* 2013;34:439–453.
33. Pittet V, Juillerat P, Mottet C, et al. Cohort profile: the Swiss Inflammatory Bowel Disease Cohort Study (SIBDCS). *Int J Epidemiol.* 2009;38: 922–931.
34. Siegrist J, Li J, Montano D. *Psychometric Properties of the Effort-Reward Imbalance Questionnaire*. Duesseldorf, Germany: Department of Medical Sociology FoM, Duesseldorf University; 2014.
35. Theorell T, Jood K, Jarvholm LS, et al. A systematic review of studies in the contributions of the work environment to ischaemic heart disease development. *Eur J Public Health.* 2016;26:470–477.
36. Herr RM, Bosch JA, Loerbroks A, et al. Three job stress models and their relationship with musculoskeletal pain in blue- and white-collar workers. *J Psychosom Res.* 2015;79:340–347.
37. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol.* 1996;1:27–41.
38. Schulz M, Damkroger A, Heins C, et al. Effort-reward imbalance and burnout among German nurses in medical compared with psychiatric hospital settings. *J Psychiatr Ment Health Nurs.* 2009;16:225–233.
39. Unterbrink T, Hack A, Pfeifer R, et al. Burnout and effort-reward-imbalance in a sample of 949 German teachers. *Int Arch Occup Environ Health.* 2007;80:433–441.
40. Hinz A, Zenger M, Brahler E, et al. Effort-reward imbalance and mental health problems in 1074 German teachers, compared with those in the general population. *Stress Health*. 2016;32:224–230.
41. Kudielka BM, von Kändel R, Gander ML, et al. Effort-reward imbalance, overcomittment and sleep in a working population. *Work Stress*. 2004;18: 167–187.
42. Kivimaki M, Nyberg ST, Batty GD, et al. Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. *Lancet*. 2012;380:1491–1497.
43. Li J, Zhang M, Loerbroks A, et al. Work stress and the risk of recurrent coronary heart disease events: a systematic review and meta-analysis. *Int J Occup Med Environ Health.* 2015;28:8–19.
44. Innstrand ST, Langballe EM, Falkum E. A longitudinal study of the relationship between work engagement and symptoms of anxiety and depression. *Stress Health*. 2012;28:1–10.
45. Keefer L, Keshavarzian A, Mutlu E. Reconsidering the methodology of "stress" research in inflammatory bowel disease. *J Crohn's Colitis.* 2008; 2:193–201.
46. Levenstein S, Prantera C, Varvo V, et al. Stress and exacerbation in ulcerative colitis: a prospective study of patients enrolled in remission. *Am J Gastroenterol.* 2000;95:1213–1220.
47. Mittermaier C, Dejaco C, Waldhoer T, et al. Impact of depressive mood on relapse in patients with inflammatory bowel disease: a prospective 18-month follow-up study. *Psychosom Med.* 2004;66:79–84.